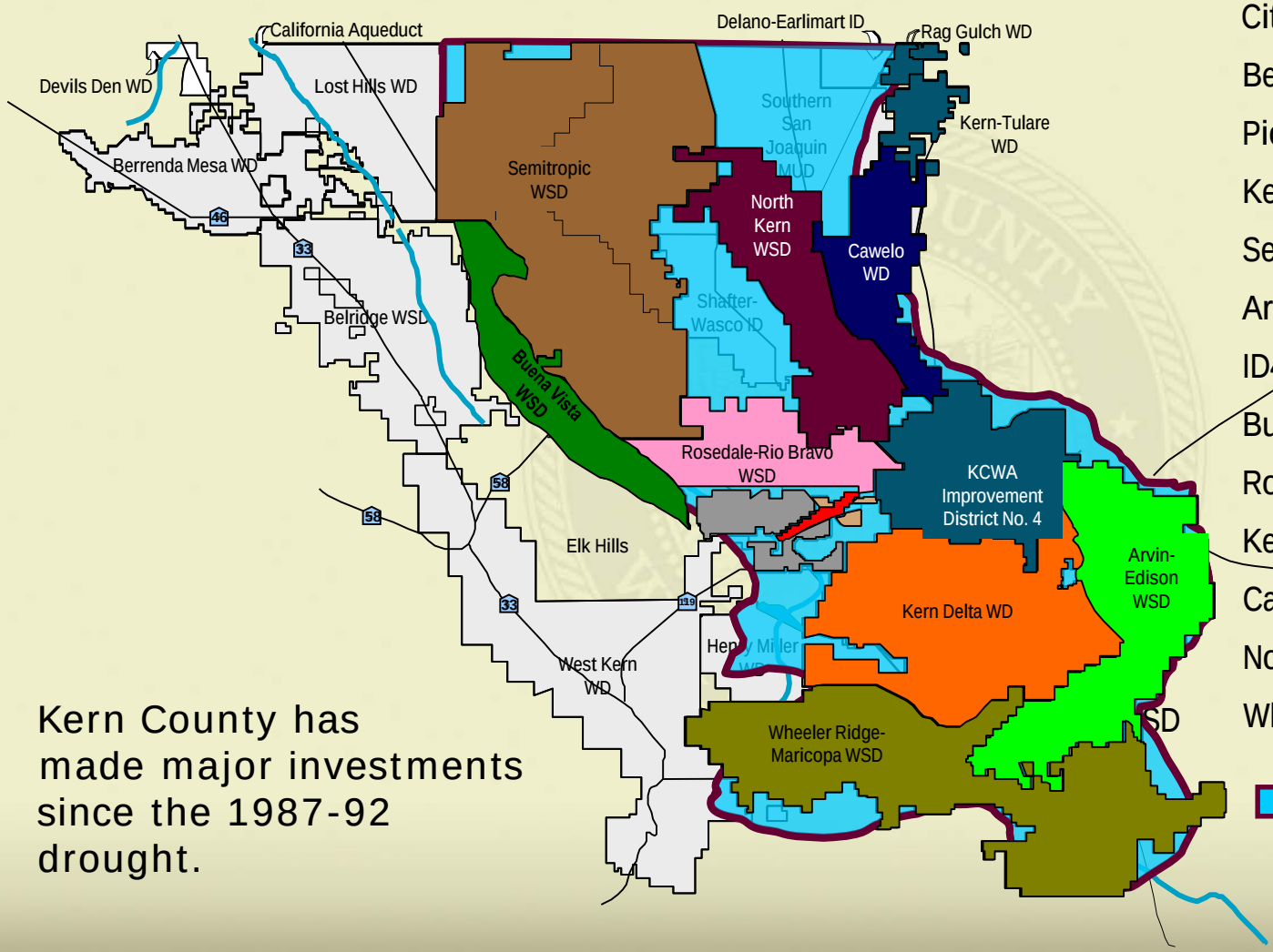
Groundwater Banking and Water Quality Modeling

For MWQI

Kern County Water Sources – Applied Use

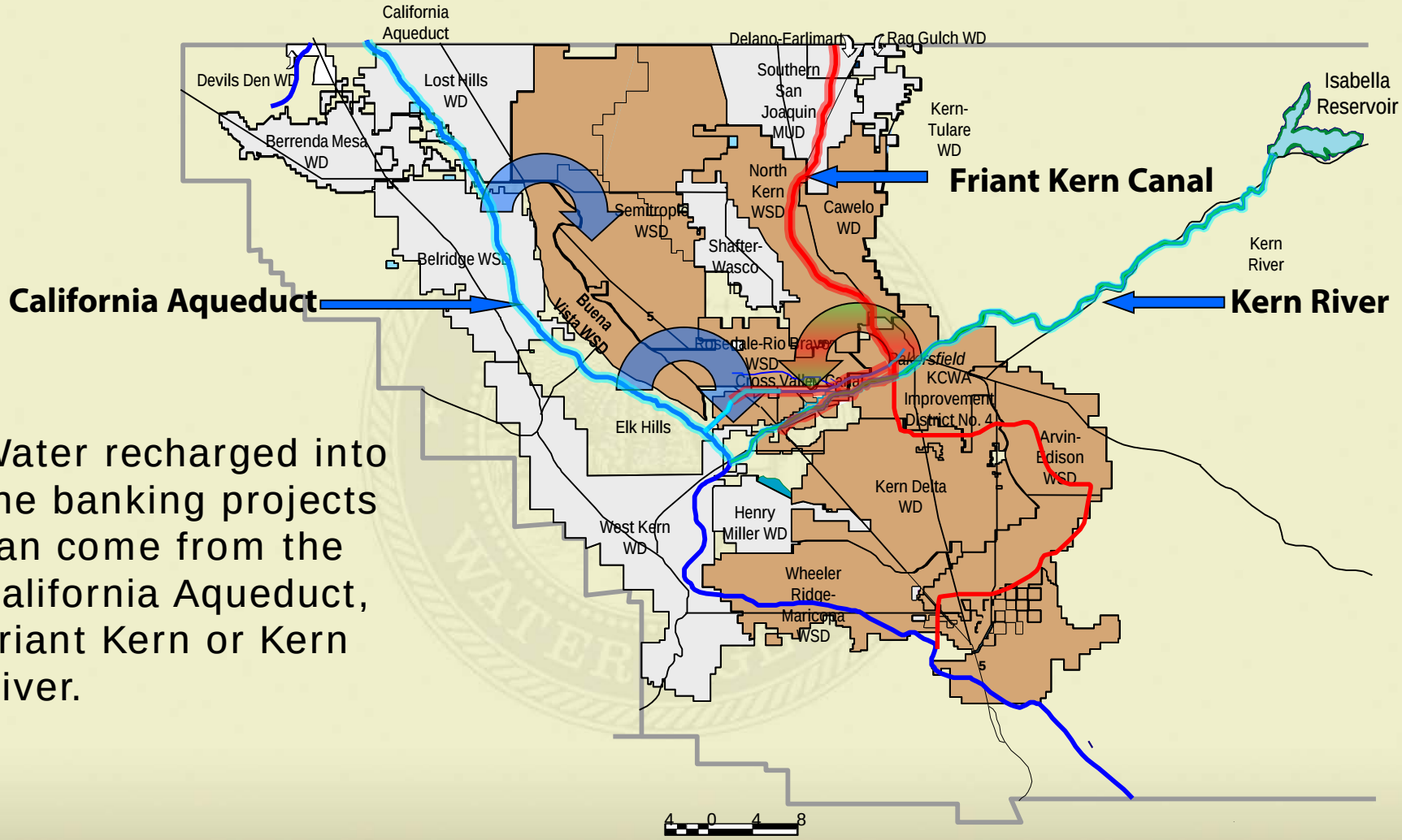
	Average		2014 est.	
Source	Acre-feet	%	%	Acre-feet
Kern River	764,000	21%	**4 %**	150,000
State Water Project	838,000	21%	**5 %**	50,000
Central Valley Project	404,000	12%	**0 %**	0
Local Streams and other sources	305,000	15%	**0 %**	0
Groundwater	1,365,000	31%	**91 %**	3,476,000
TOTAL	3,676,000	100%	100%	3,676,000

Kern County Groundwater Banking Programs



Kern County has made major investments since the 1987-92 drought.

Multiple Sources Are Key

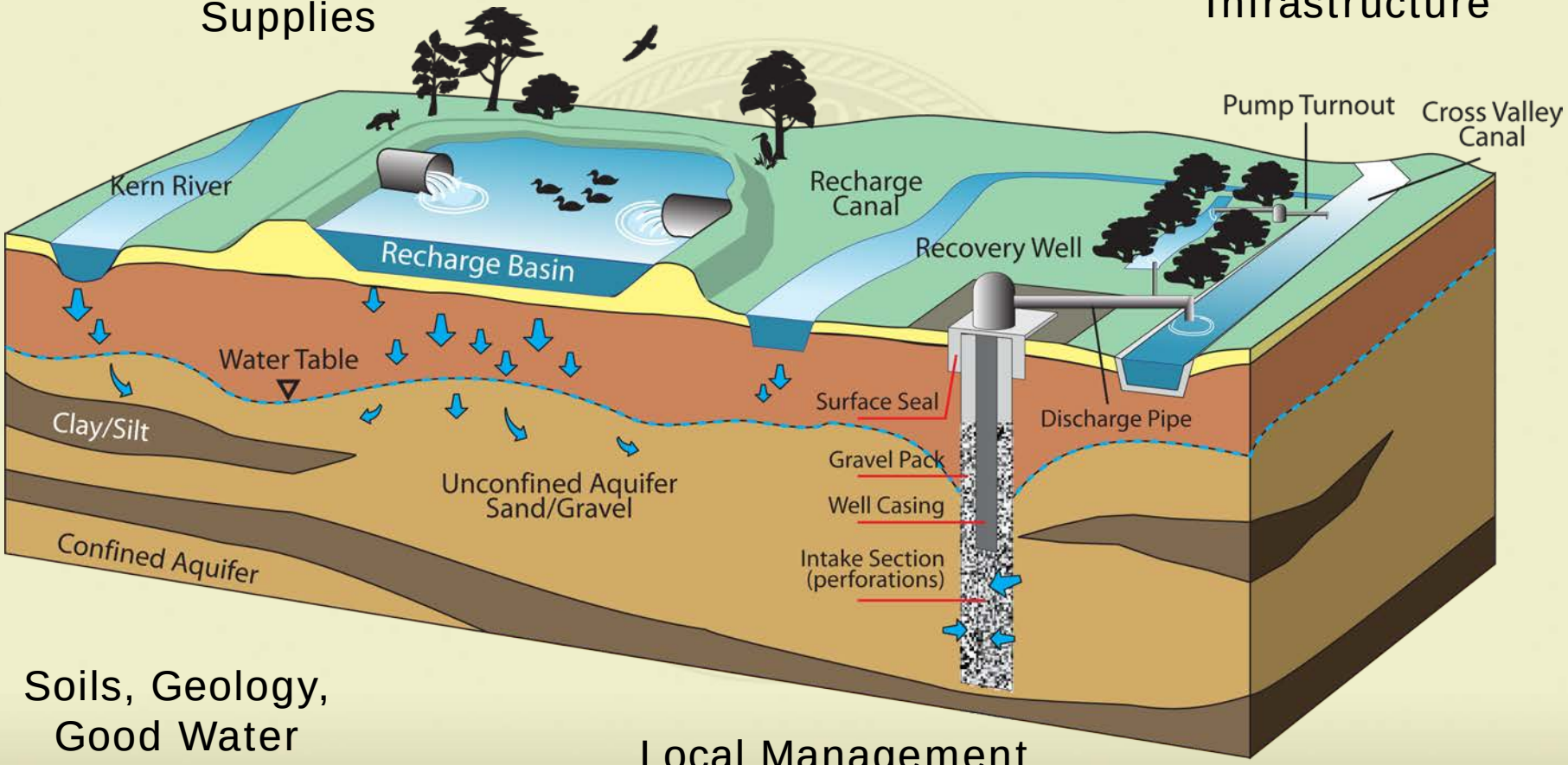


Water recharged into the banking projects can come from the California Aqueduct, Friant Kern or Kern River.

Four Key to Success with Groundwater Banking

Multiple Water Supplies

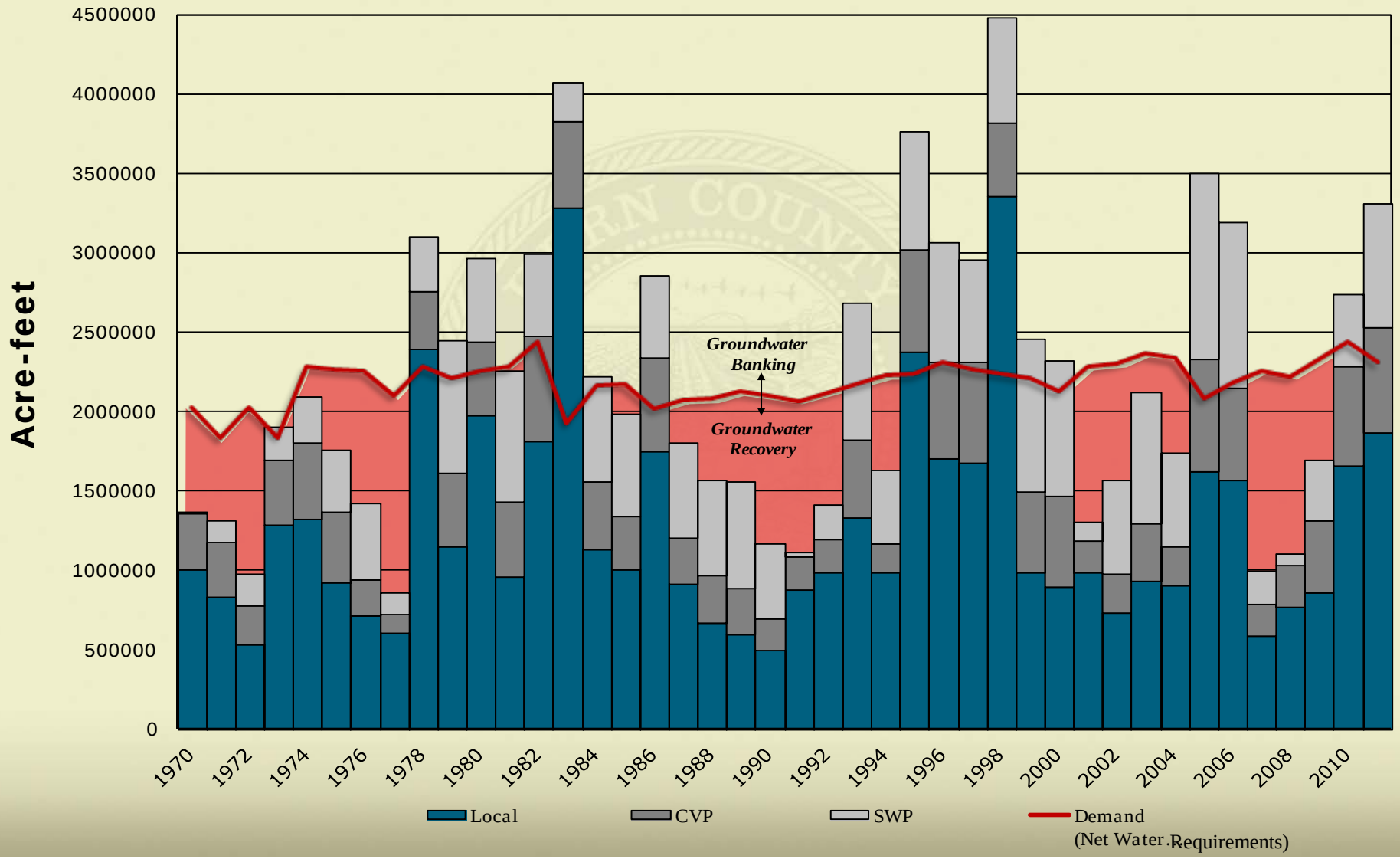
Facility Infrastructure

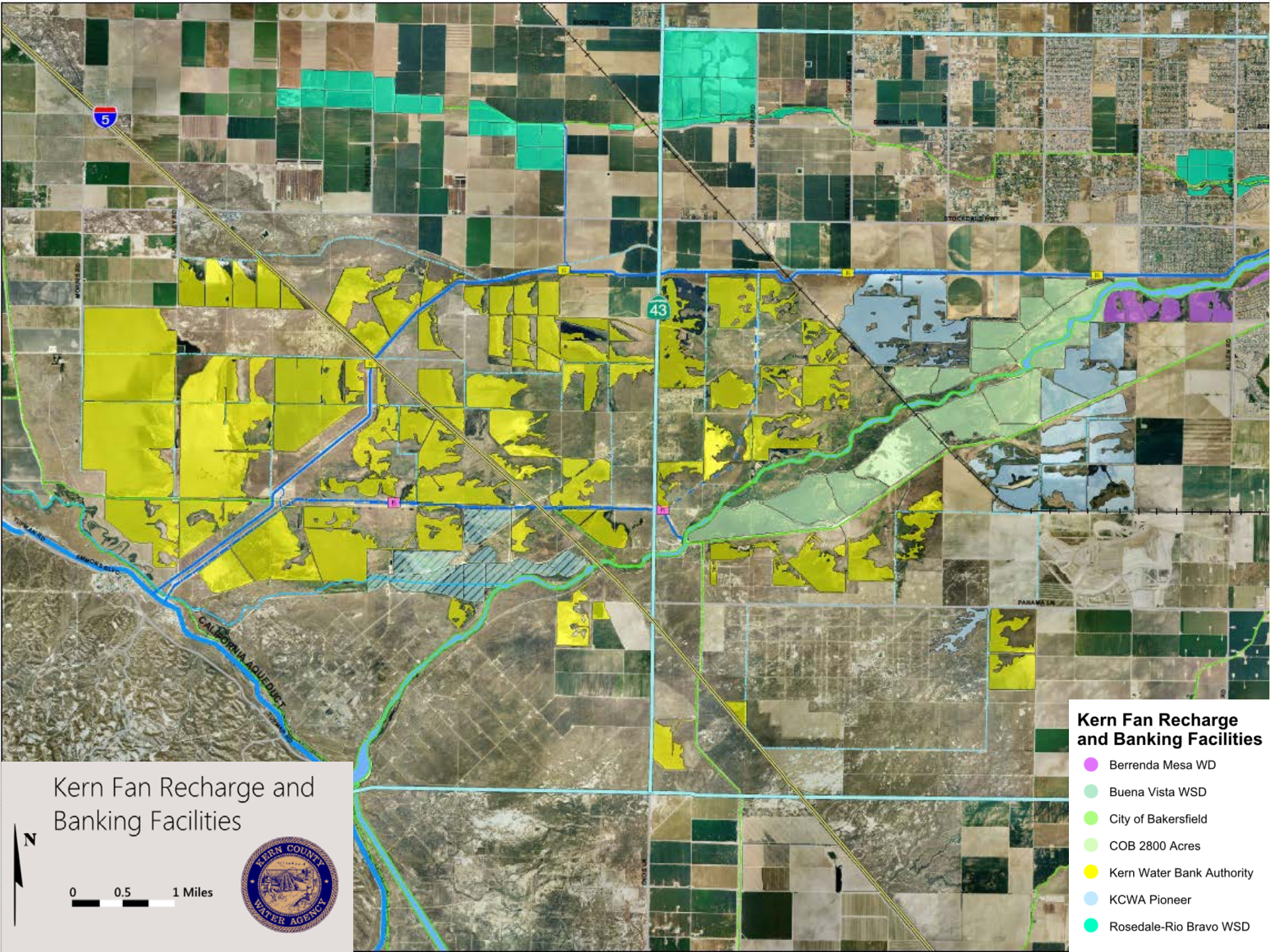


Soils, Geology, Good Water Quality

Local Management and Support

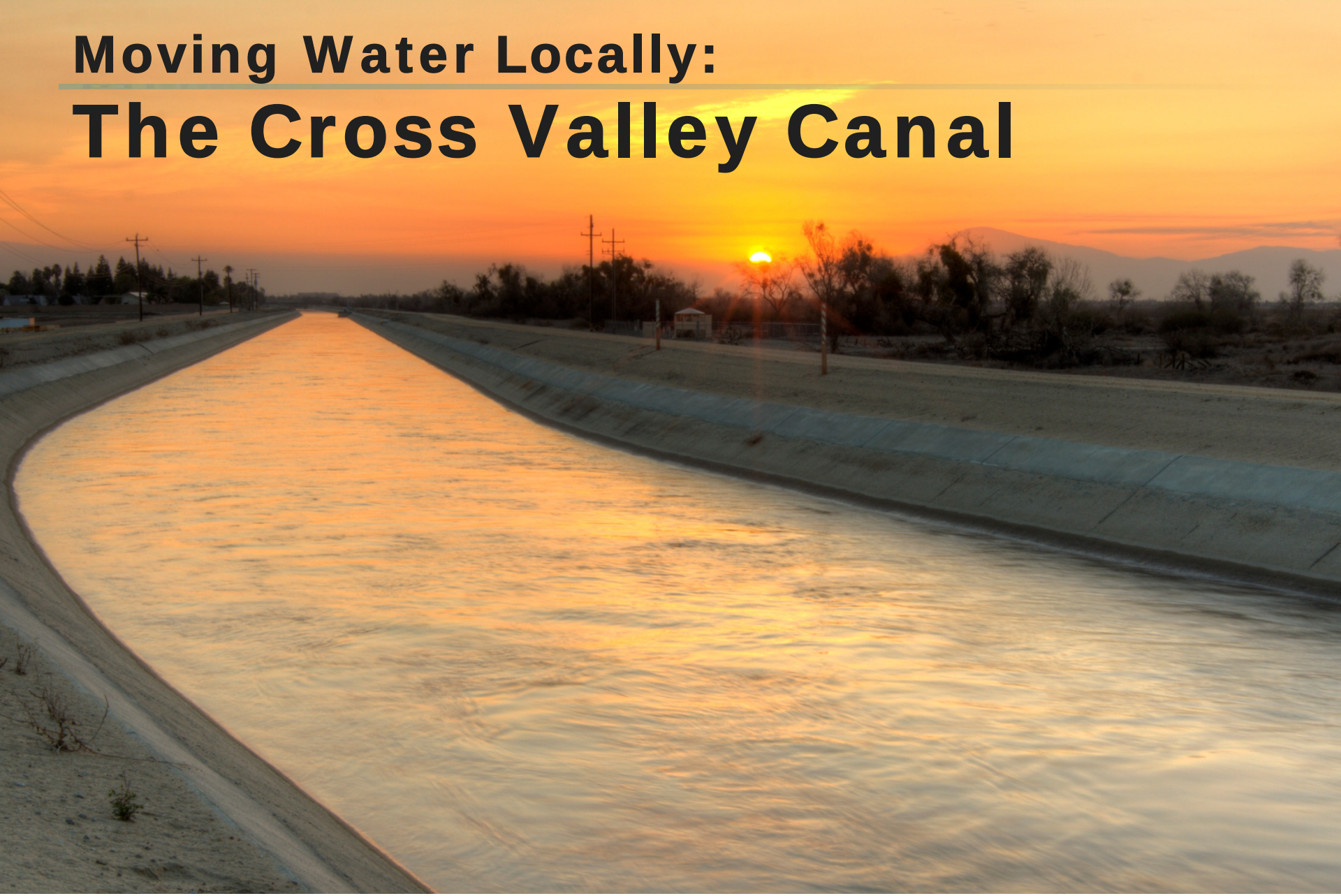
Water Supplies and Demands, SJV Portion of Kern




Kern Fan Recharge and Banking Facilities
N
0 0.5 1 Miles
KERN COUNTY WATER AGENCY
Kern Fan Recharge and Banking Facilities
Berrenda Mesa WD
Buena Vista WSD
City of Bakersfield
COB 2800 Acres
Kern Water Bank Authority
KCWA Pioneer
Rosedale-Rio Bravo WSD
CALIFORNIA AQUEDUCT
5
43

Moving Water Locally:

The Cross Valley Canal



An Overview of Water Management in Kern County

Cross Valley Canal Background

- Cross Valley Canal (CVC) and CVC Extension were constructed in the mid-1970's at a cost of $22 million
- Twelve original participating entities in Kern, Tulare and Fresno counties
- Conveyance of imported State Water Project surface water supply from California Aqueduct
- 3/4ths of the CVC is concrete lined; 1/4th is unlined
- 736 cubic feet per second (cfs) design
- Pumping plant capacities increased by 25% to 922 cfs in mid-1990s at a cost of $1.5 million

Kern Fan Groundwater Banking Projects

Facing East

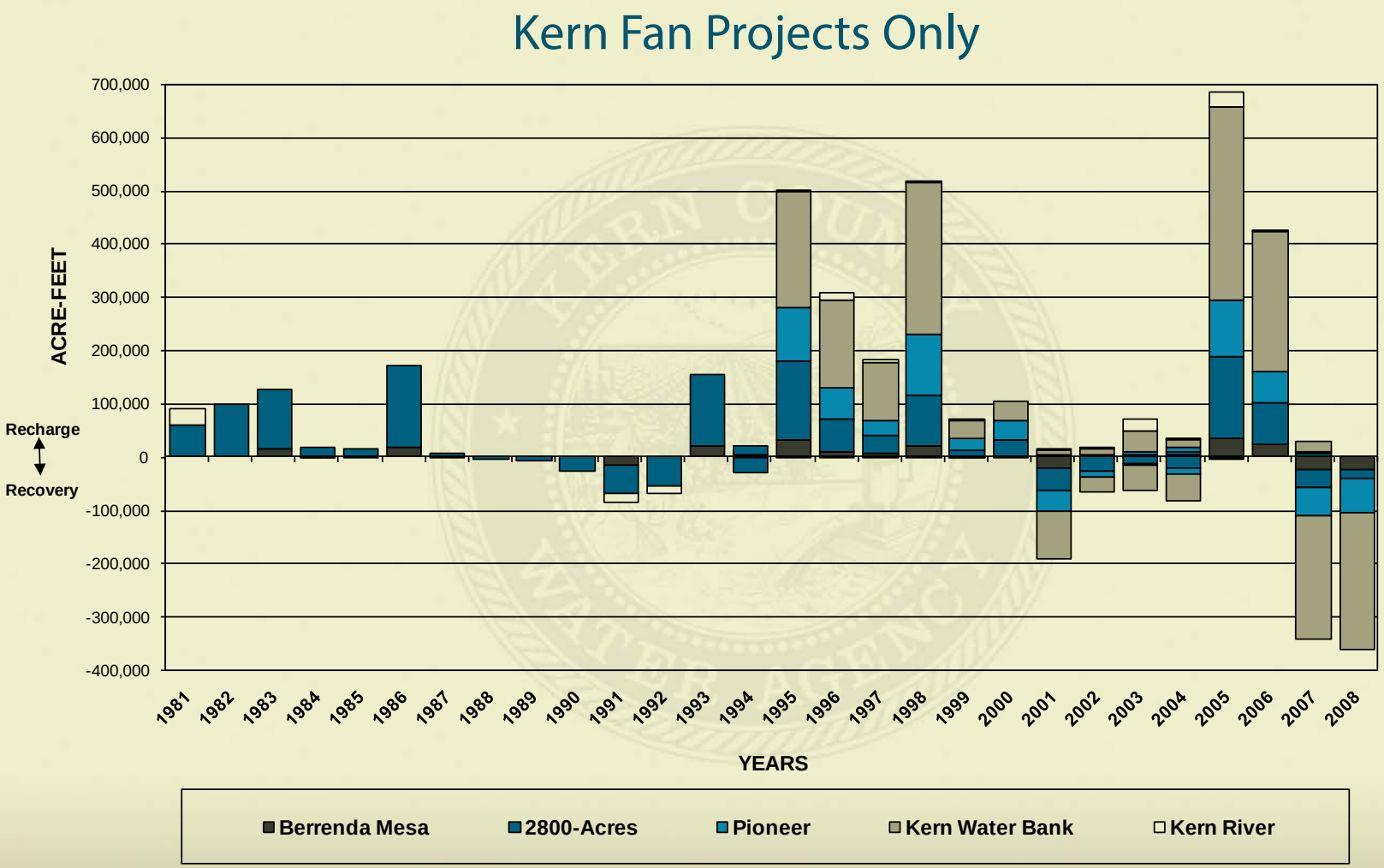
Kern Fan Groundwater Banking Projects

Facing Southwest

Berrenda Mesa / Kern County Water Agency

Joint Groundwater Banking Project – Basin 1

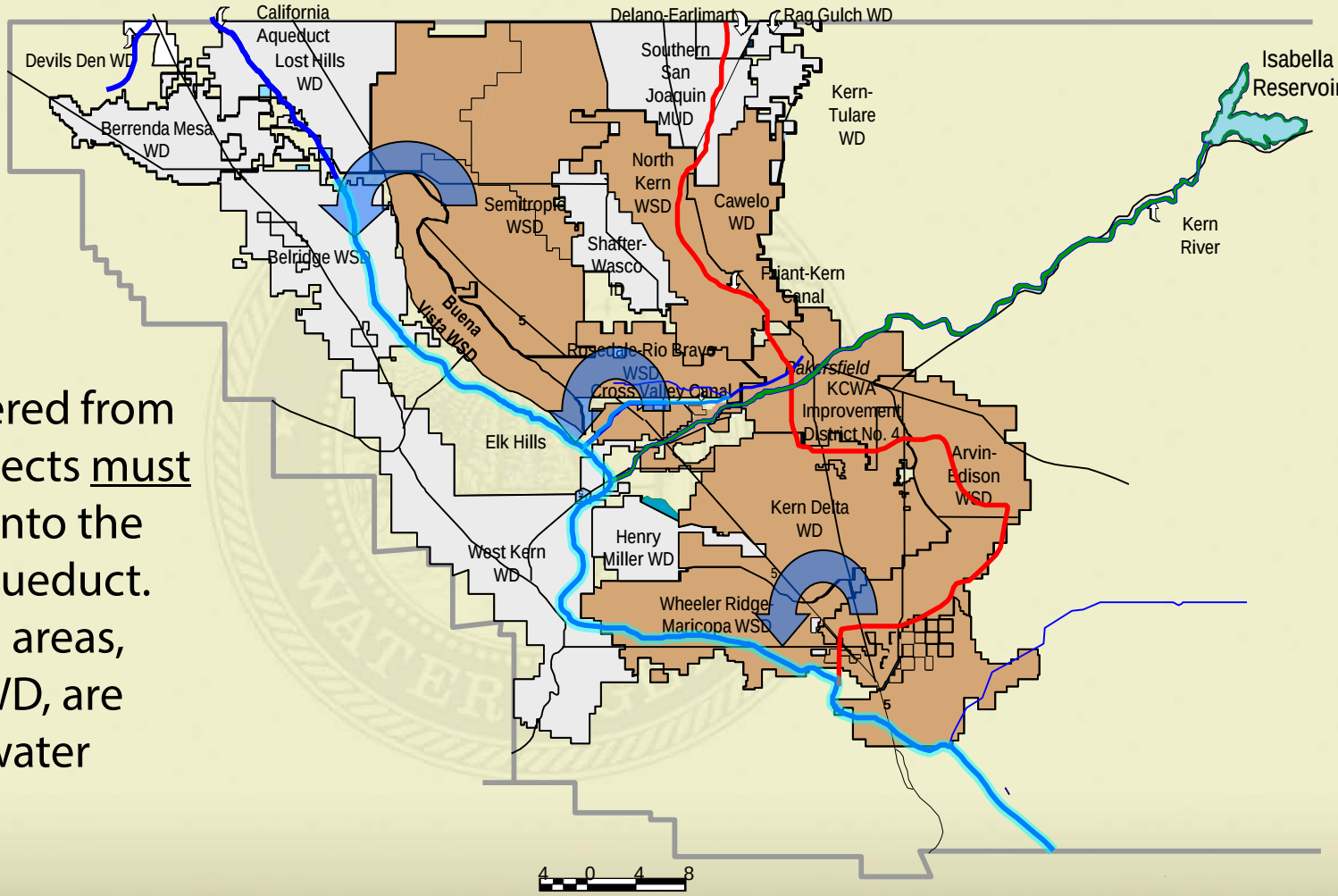
Annual Recharge and Withdrawal



Recovery Well

California Aqueduct is Key for Recovery

Water recovered from banking projects must be pumped into the California Aqueduct. Downstream areas, primarily MWD, are affected by water quality.



Pump-in Tiers

- Tier 1

  Tier 1 NP pump-in proposals (PIP) shall exhibit water quality that is essentially the same, or better, than what occurs in the California Aqueduct. PIP's considered to be Tier 1 shall be approved by DWR.

- Tier 2

  Tier 2 PIP's are those that exhibit water quality that is different and possibly worse than in the California Aqueduct and/or have the potential to cause adverse impacts to the Contractors. Tier 2 PIP's shall be referred to a NP Facilitation Group (FG), which would review the project and if needed make recommendations to DWR in consideration of the PIP.

  - *One Requirement of a Tier 2 PIP: Identify anticipated water quality changes within the SWP.*

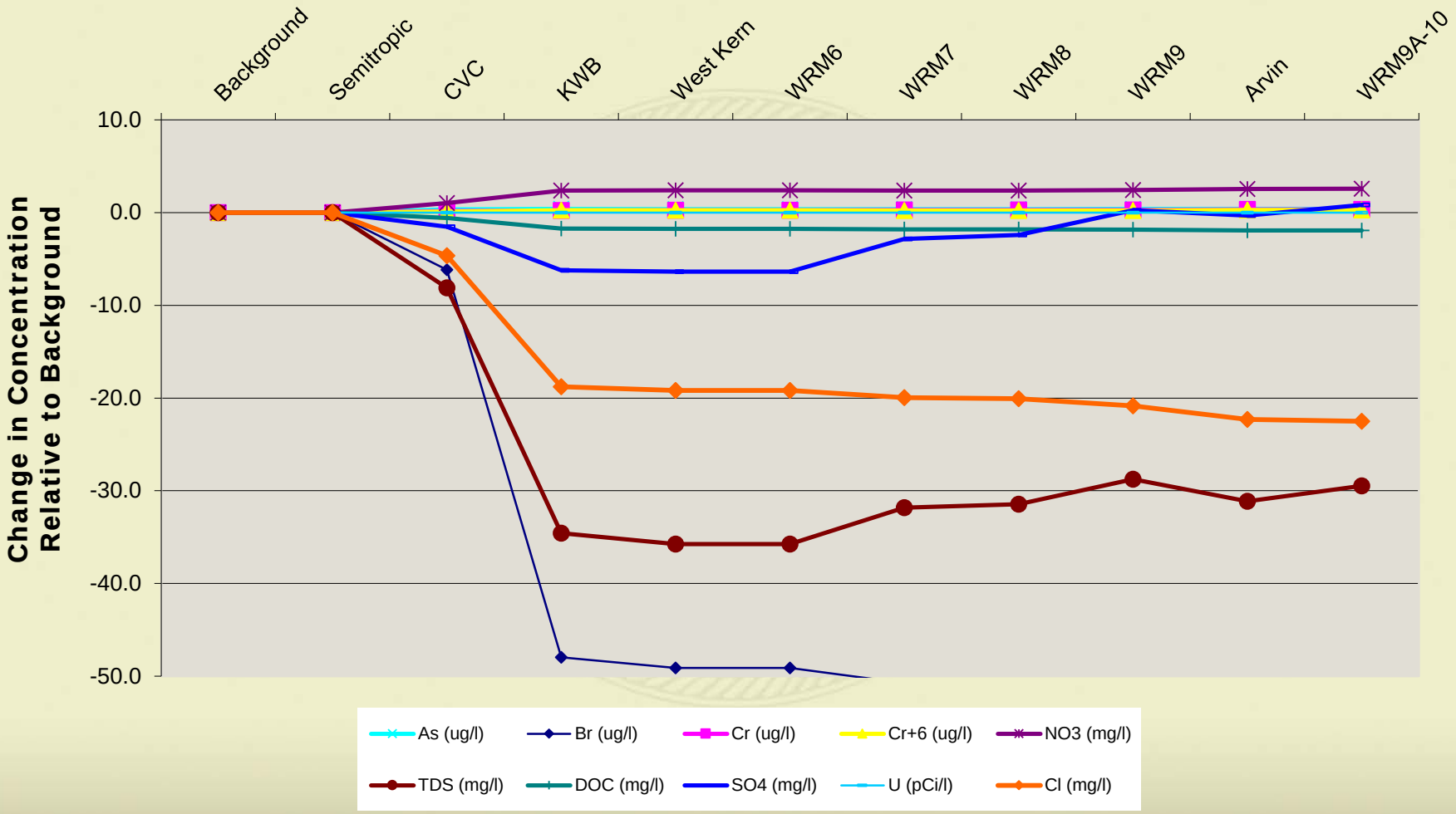
Modeling COCs by Well and Conveyance Facility

Manifold	Flow	As	Br	Cr	Cr+6	NO3	TDS	DOC	SO4	U	Cl
	cfs	ug/l	ug/l	ug/l	ug/l	mg/l	mg/l	mg/l	mg/l	pCi/l	mg/l
Semitropic*	0	-	-	-	-	-	-	-	-	-	-
CVC Pool 1	46	9.7	104	4.6	1.3	8.1	305	0.5	92	4.8	48.7
CVC Pool 2	36	4.2	431	1.4	1.1	13.5	339	0.5	36	12.5	77.3
CVC Pool 3	33	7.8	511	2.1	1.9	15.8	343	1.2	30	3.0	89.6
CVC Pool 4	69	2.1	133	1.6	1.3	11.1	219	1.1	27	8.6	29.3
CVC Pool 5 & 6	112	2.1	79	1.0	1.0	4.6	150	0.6	17	2.2	20.3
CVC Subtotal: East	170	2.1	98	1.2	1.1	6.9	174	0.8	21	4.4	23.4
CVC Subtotal: West	125	7.0	306	2.8	1.4	11.9	317	0.7	54	6.9	65.9
River Canal	108	3.7	120	1.6	1.4	7.7	185	0.8	27	5.2	20.3
KWB Canal	206	5.0	195	1.4	1.0	8.8	313	0.5	54	16.6	53.5
West Kern	13	2.2	178	5.9	1.0	4.2	203	0.6	40	13.8	39.9
WRM6	0	-	-	-	-	-	-	-	-	-	-
WRM7	20	3.4	185	2.8	0.1	0.9	780	0.5	383	3.2	31.3
WRM8	2	6.2	130	10.0	0.2	7.3	700	0.3	410	3.6	-
WRM9	11	6.6	125	1.0	0.1	8.1	731	0.8	410	2.0	4.6
WRM9A-10	4	3.8	207	1.0	0.2	11.0	919	0.5	439	7.6	39.2
WRM13A	0	-	-	-	-	-	-	-	-	-	-
WRM15	0	-	-	-	-	-	-	-	-	-	-
WRMWSD Subtotal	36	4.5	167	2.4	0.1	4.5	778	0.6	399	3.4	22.9
Arvin-Edison	20	8.7	86	4.4	3.8	12.7	231	0.3	31.3	-	-
Well Blend in Aqueduct	508	5.2	199	2.1	1.2	9.1	314	0.6	72	10.1	44.8

Modeling Anticipated Changes within Aqueduct

	Total Flow	Constituent Concentrations									
		As	Br	Cr	Cr+6	NO3	TDS	DOC	SO4	U	Cl
cfs MCL		ug/l 10	ug/l None	ug/l 50	ug/l 10	mg/l 45	mg/l 500	mg/l None	mg/l 250	pCi/l 20	mg/l 250
CVC Eastward Flow	170	2.1	98	1.2	1.1	6.9	174	0.8	21	NA	23.4
Percent of the MCL	NA	21%	NA	2%	NA	15%	35%	NA	8%	NA	9%
Aqueduct Blends											
Background	1353	4.0	400	1.0	0.3	0.3	418	7.3	72	NA	122.0
After Semitropic	1233	4.0	400	1.0	0.3	0.3	418	7.3	72	NA	122.0
After CVC	1011	4.4	388	1.2	0.4	1.7	406	6.5	70	NA	115.0
After KWB	1325	4.4	336	1.3	0.6	3.3	373	5.1	64	NA	97.8
After West Kern	1298	4.4	335	1.3	0.6	3.3	371	5.1	64	NA	97.2
After WRMWSD 6	1131	4.4	335	1.3	0.6	3.3	371	5.1	64	NA	97.2
After WRMWSD 7	1075	4.4	332	1.4	0.6	3.3	379	5.0	69	NA	96.0
After WRMWSD 8	1035	4.4	332	1.4	0.6	3.3	379	5.0	70	NA	95.8
After WRMWSD 9	1038	4.4	330	1.4	0.6	3.4	383	4.9	74	NA	94.9
After Arvin-Edison	1058	4.5	325	1.4	0.6	3.5	380	4.8	73	NA	93.1
After WRMWSD 9A-10	1005	4.5	325	1.4	0.6	3.6	382	4.8	74	NA	92.9
After WRMWSD 13A	998	4.5	325	1.4	0.6	3.6	382	4.8	74	NA	92.9
After WRMWSD 15	925	4.5	325	1.4	0.6	3.6	382	4.8	74	NA	92.9
Total Change	-428	0.5	-75	0.4	0.3	3.3	-36	-2.5	2	NA	-29.1
Percent of the MCL	NA	4.7%	NA	0.8%	NA	7.2%	-7.1%	NA	0.9%	NA	-0.1

Aqueduct Pump-in Program Changes by Location



Constituent of Concern Sampling – Q2 2014 (May 29, 2014) vs Kern Model Projections

Constituent	Upstream Aqueduct			CVC Pump-In			KWB Pump-In			Downstream Aqueduct		
	Sample	*Kern Model*	*Difference*	*Sample*	*Kern Model*	*Difference*	*Sample*	*Kern Model*	*Difference*	*Sample*	*Kern Model*	*Difference*
Nitrate (mg/L)	< 0.11	0.1	0	6.6	8.6	-2	6.1	8.4	-2.3	3.1	7.5	-4.4
Sulfate (mg/L)	75	54	21	30	35	-5	42	51	-9	57	40	17
TDS (mg/L)	490	396	94	240	231	9	250	306	-56	340	265	75
TOC (mg/L)	5.9	4.9	1	0.59	0.8	-0.21	0.64	0.5	0.14	2.6	1.2	1.4
Arsenic (ug/L)	4.2	2	2.2	4.2	4.4	-0.2	8.3	5.1	3.2	5.7	4.3	1.4
Hexavalent Chromium (ug/L)	0.25	0.1	0.15	0.97	1.2	-0.23	1.3	1	0.3	0.8	1.1	-0.3
Bromide (mg/L)	0.42	0.39	0.03	0.16	0.183	-0.023	0.16	0.193	-0.033	0.29	0.197	0.093
Chloride (mg/L)	140	122	18	36	41	-5	40	52	-12	90	50	40

Challenges of Modeling

- Changes in Aqueduct flow throughout the day
  - Increase/decrease in demands
  - Edmonston Pumping Plant
- Changes in CVC demands
  - Increase/decrease in demands
- Well production updates
- Coordination with other programs
- Assumed background COC levels

Contact Information

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